Innovative Distributed Power Interconnection and Control Systems

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Who Is Encorp?

- Fast-growing company located in Windsor, CO
- Encorp is a technology-driven company focused on addressing the digital economy's principal power-related issues: power quality and reliability
- Encorp designs, develops and manufactures communication, control and grid interconnection products and services for the global power-quality and distributed-generation markets

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Program Goals

- Cost-effective DP grid interconnection products, software, and communication solutions
- Improved economics for broad range of DP power systems
  - 50 kW to 5 MW (and up)
- Enhanced DP product capability to integrate, interact, and provide operational benefits
  - Within building energy management systems and electric power systems

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Work Plan – Three Phases

- **Core Enabling Technology and Software Development**
  - **Base Year**
  - **Developing Next Generation *en*power™ Controller**
  - **Significant Performance Enhancement Compared With Existing *en*power GPC Product Offering**
    - Build on lessons learned from well over 1000 GPC installations
- **Application and System Level Command and Control**
  - **Option Year One**
- **Further Development and Validation of Industry Communication Standards**
  - **Option Year Two**

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Program Plan/Tasks

Core Enabling Technology	
(1)	Develop Prototype Advanced Controller
(2)	Develop Prototype Power Sensing Board
(3)	Expanded Suite of Communication Capabilities
(4)	Interface for Revenue-Grade Meter
(5)	Demonstrate Interconnect DP Device
System Level Command & Control	
(6)	Type Testing
(7)	System Command and Control
(8)	Demonstration of Controlled DP
Interoperability & Communications	
(9)	Interoperability Systems Analysis
(10)	Demonstration of Grid-DP Interoperability

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Core Enabling Technology
GPC Enhancements

- **Performance**
- **Communications**
- **Scalability**
- **IEEE P1547 Compliant**
- **Functionality**
- **Programmability**
- **Serviceability**
- **Lower System Cost**

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GPC II Performance Enhancements

- **Goal: Improve Processing Speed**
  - **Enable high speed digital signal processing (DSP)**
  - **More rapid event recognition and response**
- **PowerPC CPU**
  - **Provides 10x Performance Improvement**
- **DSP in Power Sensor Module**
  - **High Speed Current and Voltage Cycle Measurements**
- **Together, These Provide 20x improvement In Performance Over Current Designs**

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GPC II Communications Enhancements

- **Goal: Suite of Communication Options To Enable Flexible Inter-Device & Network Connectivity**
  - **Tie-In With Various Generators, Prime Mover Controls, Building Energy Management Systems, and Network Controllers**
- **LonWorks**
- **10/100 Ethernet channel**
- **(2) CAN/DeviceNet channels**
- **(2) RS-232/485 channels**
- **Network communication support**
  - **TCP/IP, UDP, ARP, ICMP, DNS, DHCP, PPP, etc…**

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GPC II Scalability Enhancements

- **Goal: Flexible Design Platform To Meet Cost & Feature Requirements of Both Small & Large Generators**
- **Increased Standard Input/Output (I/O)**
- **Optional I/O Module**
- **Accepts 2 M-Modules**
- **More Networked I/O Options**
- **Expandable Power Sensor Modules**

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GPC II P1547 Standard Compliant

- Goal: Product Enhancement To Meet/Exceed Standard
- Improved and Expanded Protective Relay Performance
- New Loss of Synchronism Relay
- New Islanding Detection Relay
- Increased EMI and Surge Withstand Immunity

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GPC II Functional Enhancements

- **Accept Multiple Power Sensors**
  - **Second 3-phase sensor on bus**
  - **Over-current relay**
  - **Differential current relay**
- **Revenue Grade Metering Accuracy**
  - **Initial focus on KYZ pulse meter devices**
- **Internet Connectivity**
- **Data Logging and Sequence of Events Logging**
- **Alarming, Trending, and Wave Form Capture**

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Current Status and Issues

- **Functional Product Specifications**
  - **Selection of more powerful platform resulted in more effort on electronics design, software development, and migration**
  - **Total development costs increased (more than 50%) from original estimate**
    - Increased number of pre-production prototypes to be built for evaluation
    - Full Encorp management support for development program
    - Design will have improved functionality and value proposition to customers
- **Prototype Field Testing Delayed**
  - **Will not be completed within Base Year**
  - **Software development and testing required before formal field testing**
  - **Plan on completing in 2002**

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Base Year Task Summary

Task	Activity	% Complete/ Completion Date
1	Develop Prototype Advanced Controller	70% Mid January
2	Develop Prototype Power Sensing Board	70% Mid January
3	Expanded Suite of Communication Capabilities	70% Mid January
4	Revenue Grade Meter	70% Mid January
5	Demonstrate Interconnected Distributed Power	0% (combine with Task 8) 3Q/2002

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Summary

- Program is underway in terms of core technology development
  - High performance platform in final develop stage
  - Software migration and enhanced product testing and refinement tasks have extended product release
- Exploring approaches for type testing in Option Year One
  - Conformance with industry standards
  - Support IEEE P1547

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